

The documentation and process conversion measures necessary to comply with this revision shall be completed by 30 April 2009.

INCH-POUND

MIL-PRF-19500/582B
30 January 2009
SUPERSEDING
MIL-PRF-19500/582A
21 August 1999

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON AMPLIFIER,
TYPES 2N5679 AND 2N5680, JAN, JANTX AND JANTXV

This specification is approved for use by all Departments
and Agencies of the Department of Defense.

* The requirements for acquiring the product described herein shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for PNP, silicon, amplifier transistor. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1, (TO-39).

* 1.3 Maximum ratings. Unless otherwise specified, $T_A = +25^\circ\text{C}$.

Type	P_T (1) $T_A = +25^\circ\text{C}$	P_T $T_C = +25^\circ\text{C}$ (2)	$R_{\theta JC}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	I_B	T_J and T_{STG}
	<u>W</u>	<u>W</u>	<u>$^\circ\text{C}$</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u>$^\circ\text{C}$</u>
2N5679	1.0	10	17.5	100	100	4.0	1.0	0.5	-65 to +200
2N5680	1.0	10	17.5	120	120	4.0	1.0	0.5	

(1) Derate linearly 5.7 mW/ $^\circ\text{C}$ for $T_A > +25^\circ\text{C}$;

(2) Derate linearly 57mW/ $^\circ\text{C}$ for $T_C > +25^\circ\text{C}$.

1.4 Primary electrical characteristics at $T_A = +25^\circ\text{C}$.

Limits	h_{FE} at $V_{CE} = 2.0$ V dc (1)			h_{fe} / $f = 10$ MHz	C_{obo} $f = 1.0$ MHz	$V_{CE(sat)}$ 1 (1) $I_C = 250$ mA dc $I_B = 25$ mA dc	$V_{BE(sat)}$ 1 (1) $I_C = 250$ mA dc $I_B = 25$ mA dc
	h_{FE1} $I_C = 250$ mA dc	h_{FE2} $I_C = 500$ mA dc	h_{FE3} $I_C = 1.0$ A dc	$V_{CE} = 10$ V dc $I_C = 100$ mA dc	$V_{CB} = 20$ V dc $I_E = 0$		
Min	40	20	5	3.0	<u>pF</u>		<u>V dc</u>
Max	150				50	0.6	1.1

(1) Pulsed see 4.5.1.

* Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dsc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil/>.

2. APPLICABLE DOCUMENTS

* 2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

* 2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

* DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

* DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

* (Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

* 2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

* 3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

* 3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figure 1 (TO-39) herein.

3.4.1 Lead material and finish. Lead finish shall be solderable as specified in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead material or finish is desired, it shall be specified in the acquisition document (see 6.2).

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

* 3.7 Electrical test requirements. The electrical test requirements shall be as specified in table I.

* 3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

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Symbol (see note 3)	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	0.305	.335	7.75	8.51	
CH	0.240	.260	6.10	6.60	
HD	0.335	.370	8.51	9.39	
LC	0.200 BSC		5.08 BSC		9
LD	0.016	0.021	0.41	0.53	9, 10
LL	0.500	0.750	12.70	19.05	10, 11
LU	0.016	0.019	0.41	0.48	10, 11
L ₁		0.050		1.27	10, 11
L ₂	0.250		6.35		10, 11
P	0.100		2.54		8
Q		0.050		1.27	7
r		0.010		0.25	12
TL	0.029	0.045	0.74	1.14	6
TW	0.028	0.034	0.72	0.86	5
α	45° BSC				9
Term 1	Emitter				
Term 2	Base				
Term 3	Collector				

* FIGURE 1. Physical dimensions for (TO-39) - Continued.

NOTES:

1. Dimensions are in inches.
- * 2. Millimeters are given for general information only.
3. Refer to applicable symbol list.
4. Lead number 1 is the emitter, lead number 2 is the base, lead number 4 is omitted from this outline. The collector is number 3 and is electrically connected to the case.
5. Beyond r (radius) max, TW shall be held for a minimum length of .011 inch (0.28 mm).
6. TL measured from maximum HD.
7. Outline in this zone is not controlled.
8. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
9. Leads at gauge plane .054 + .001 - .000 inch (1.37 +0.03 - 0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
10. LU applies between L₁ and L₂. LD applies between L₂ and LL minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
11. All three leads.
12. r (radius) applies to both inside corners of tab.
- * 13. In accordance with ASME Y14.5M, diameters are equivalent to ϕ x symbology.

* FIGURE 1. Physical dimensions for (TO-39) - Continued.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3).
- c. Conformance inspection (see 4.4 and tables I and II).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and herein.

* 4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table III tests, the tests specified in table III herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

* 4.3 Screening (JANTX, and JANTXV levels only). Screening shall be in accordance with table E-IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table E-IV of MIL-PRF-19500)	Measurement
	JANTX and JANTXV levels
(1) 3c	Method 3131 (see 4.3.2)
11	I_{CBO} , and h_{FE2}
12	See 4.3.1
13	Subgroup 2 of table I herein $\Delta I_{CBO} = 100$ percent of initial value, or 10 nA dc whichever is greater; $\Delta h_{FE2} = \pm 15$ percent of initial value.

- (1) Shall be performed anytime after temperature cycling, screen 3a; and does not need to be repeated in screening requirements.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: $V_{CB} \geq 20$ V dc; P_T 1.0 W at $T_A = 30^\circ\text{C} \pm 5^\circ\text{C}$. NOTE: No heat sink or forced air cooling on the devices shall be permitted.

* 4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining I_M , I_H , t_H , t_{SW} (and V_H where appropriate). See table III, group E, subgroup 4 herein. Measurement delay time (t_{MD}) = 60 μs max.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. Alternate flow is allowed for quality conformance inspection in accordance with MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with table I herein. End-point electrical measurements shall be in accordance with table I, subgroup 2 herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified. Separate samples may be used for each step. In the event of a group B failure, the manufacturer may pull a new sample at double the sample size from either the failed assembly lot or from another assembly lot from the same wafer lot. If the new "assembly lot" option is exercised, the failed assembly lot shall be scrapped. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

<u>Step</u>	<u>Method</u>	<u>Condition</u>
1	1027	Steady-state life: 340 hours, $V_{CB} \geq 20$ V dc, $T_J = 150^\circ\text{C}$ minimum. External heating of the device under test to achieve $T_J = 150^\circ\text{C}$ minimum is allowed provided that a minimum of 75 percent of rated power is dissipated. No heat sink or forced-air cooling on the devices shall be permitted. $n = 45$ devices, $c = 0$.
* 2	1026	The steady-state life test of step 1 shall be extended to 1,000 hours for each die design. Samples shall be selected from a wafer lot every twelve months of wafer production, however, step 2 shall not be required more than once for any single wafer lot. $n = 45$, $c = 0$.
3	1032	High-temperature life (non-operating), $T_A = +200^\circ\text{C}$. $n = 22$, $c = 0$.

4.4.2.1 Group B sample selection. Samples selected for group B inspection shall meet all of the following requirements:

- For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot.
- Shall be chosen from an inspection lot that has been submitted to and passed group A, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

* 4.4.3.1 Group C inspection, table E-VII (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E.
* C5	3131	See 4.3.2, $R_{\theta JC} = 17.5^\circ\text{C/W}$.
C6		Not applicable.

4.4.3.2 Group C sample selection. Samples for subgroups in group C shall be chosen at random from any lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes group A tests for conformance inspection. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

* 4.4.4 Group E inspection. Group E inspection for qualification only shall be conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and table III herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta measurements shall be in accordance with table III herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

* TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 2/</u>						
Visual and mechanical examination <u>3/</u>	2071	n = 45 devices, c = 0				
Solderability <u>3/</u>	2026	n = 15 leads, c = 0				
Resistance to <u>3/ 4/</u> solvent	1022	n = 15 devices, c = 0				
Temp cycling <u>3/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal	1071	n = 22 devices, c = 0				
Fine leak Gross leak						
Electrical measurements		Table I, subgroup 2				
Bond strength <u>3/</u>	2037	Precondition T _A = +250°C at t = 24 hrs or T _A = +300°C at t = 2 hrs, n = 11 wires, c = 0				
<u>Subgroup 2</u>						
* Thermal impedance <u>5/</u>	3131	See 4.3.2	Z _{θJC}			°C/W
Breakdown voltage collector to emitter 2N5679 2N5680	3011	Bias condition D, pulsed (see 4.5.1), I _C = 10 mA dc	V _{(BR)CEO}	100 120		V dc
Collector emitter cutoff current 2N5679 2N5680	3041	Bias condition D V _{CE} = 70 V dc V _{CE} = 80 V dc	I _{CEO}		10	μA dc
Collector emitter cutoff current 2N5679 2N5680	3041	Bias condition A, V _{BE} = 1.5 V dc V _{CE} = 100 V dc V _{CE} = 120 V dc	I _{CEX1}		100	nA dc
Collector to base cutoff current 2N5679 2N5680	3036	Bias condition D V _{CE} = 100 V dc V _{CE} = 120 V dc	I _{CBO}		100	nA dc
Emitter to base cutoff current	3061	Bias condition D, V _{BE} = 4.0 V dc	I _{EBO}		1.0	μA dc

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> Continued						
Forward current transfer ratio	3076	Pulsed (see 4.5.1), I _C = 250 mA dc, V _{CE} = 2.0 V dc	h _{FE1}	40	150	
Forward current transfer ratio	3076	Pulsed (see 4.5.1), I _C = 500 mA dc, V _{CE} = 2.0 V dc	h _{FE2}	20		
Forward current transfer ratio	3076	Pulsed (see 4.5.1), I _C = 1.0 A dc V _{CE} = 2.0 V dc	h _{FE3}	5		
Collector to emitter voltage (saturated)	3071	Pulsed (see 4.5.1), I _C = 250 mA dc, I _B = 25 mA dc	V _{CE(sat)1}		0.6	V dc
Collector to emitter voltage (saturated)	3071	Pulsed (see 4.5.1), I _C = 500 mA dc, I _B = 50 mA dc	V _{CE(sat)2}		1.0	V dc
Base emitter voltage	3066	Test condition A, pulsed (see 4.5.1), I _C = 250 mA dc, I _B = 25 mA dc	V _{BE(sat)1}		1.1	V dc
Base emitter voltage	3066	Test condition A, pulsed (see 4.5.1), I _C = 500 mA dc, I _B = 50 mA dc	V _{BE(sat)2}		1.3	V dc
<u>Subgroup 3</u>						
High-temperature operation:		T _A = +150°C				
Collector to emitter cutoff current 2N5679 2N5680	3041	Bias condition A, V _{BE} = 1.5 V dc V _{CE} = 100 V dc V _{CE} = 120 V dc	I _{CEx2}		1.0	mA dc
Low-temperature operation:		T _A = -55°C				
Forward current transfer ratio	3076	Pulsed (see 4.5.1), I _C = 250 mA dc, V _{CE} = 2.0 V dc	h _{FE4}	20		

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u>						
Small signal short circuit forward current transfer ratio	3206	$I_C = 0.2 \text{ A dc}$, $V_{CE} = 1.5 \text{ V dc}$, $f = 1.0 \text{ kHz}$	h_{fe}	40		
Magnitude of small-signal short-circuit forward-current transfer ratio	3306	$I_C = 0.1 \text{ A dc}$, $V_{CE} = 10 \text{ V dc}$, $f = 10 \text{ MHz}$	$ h_{FE} $	3		
Open circuit output capacitance	3236	$I_E = 0$, $V_{CB} = 20 \text{ V dc}$, $f = 1 \text{ MHz}$	C_{obo}		50	pF
<u>Subgroup 5</u>						
Safe operating area (continuous dc)	3051	$T_C = +25^\circ\text{C}$; $t \geq 0.5 \text{ s}$, 1 cycle.				
<u>Test 1</u>		$I_C = 1.0 \text{ A dc}$, $V_{CE} = 2 \text{ V dc}$,				
<u>Test 2</u>		$I_C = 1.0 \text{ A dc}$, $V_{CE} = 10 \text{ V dc}$,				
<u>Test 3</u>		$I_C = 50 \text{ mA dc}$, $V_{CE} = 90 \text{ V dc}$,				
Electrical measurements		See table I, subgroup 2				
<u>Subgroups 6 and 7</u>						
Not applicable						

1/ For sampling plan, see MIL-PRF-19500.

2/ For resubmission of failed subgroup A1, double the sample size of the failed test or sequence of tests.

3/ Separate samples may be used.

4/ Not required for laser marked devices.

5/ This test required for the following end-point measurements only:

Group B, step 1 of 4.4.2 herein (JAN, JANTX, and JANTXV).

Group C, subgroup 2.

Group E, subgroup 1 and 2.

TABLE II. Groups B, C, and E delta measurements. 1/ 2/ 3/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to base cutoff current 2N5679 2N5680	3036	Bias condition D $I_E = 0$ $V_{CB} = 100 \text{ V dc}$ $V_{CB} = 120 \text{ V dc}$	ΔI_{CBO}	100 percent of initial value or 10 nA dc whichever is greater.		
2.	Forward current transfer ratio	3076	$I_C = 250 \text{ mA dc}$ $V_{CE} = 2.0 \text{ V dc}$; Pulsed (see 4.5.1)	Δh_{FE1}	± 25 percent change from initial recorded value.		

1/ Devices which exceed the group A limits for this test shall not be shipped.

2/ The delta measurements for group B, 4.4.2 are as follows:

a. Step 1, see table II herein, steps 1 and 2.

b. Step 2, see table II herein, steps 1 and 2.

3/ The delta measurements for table E-IX of MIL-PRF-19500 are as follows: Subgroup 2, see table II herein, steps 1 and 2.

* TABLE III. Group E inspection (all quality levels) for qualification or re-qualification only.

Inspection	MIL-STD-750		Sample plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling	1051	Test condition G, 500 cycles.	
Hermetic seal	1071		
Fine leak			
Gross leak			
Electrical measurements		See table I, subgroup 2.	
<u>Subgroup 2</u>			45 devices c = 0
Blocking life	1048	Condition A, 1,000 hours.	
Electrical measurements		See table I, subgroup 2 and table II herein, steps 1 and 2.	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves		See MIL-PRF-19500.	
<u>Subgroup 8</u>			45 devices c = 0
Reverse stability	1033	Condition B.	

5. PACKAGING

* 5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

* (This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in MIL-PRF-19500 are applicable to this specification.)

* 6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

* 6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Lead finish (see 3.4.1).
- d. Product assurance level and type designator.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <http://assist.daps.dla.mil>.

6.4 Application guidance. The following NPN type transistor is complementary to the PNP device listed herein.

<u>NPN</u>	<u>PNP</u>
2N5681	2N5679
2N5682	2N5680

6.5 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN). This information in no way implies that manufacturer's PIN's are suitable for the military PIN.

Military PIN	Manufacturer's CAGE Code	Manufacturer's and user's PIN
JAN2N5679 or JANTX2N5679 or JANTXV2N5679	04713	2N5678 2N5679
JAN2N5680 or JANTX2N5680 or JANTXV2N5680	04713	2N5680 ST1112H

6.6 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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